THEME: Revolutionize Aviation
LEVEL I: Vehicle Systems
LEVEL II: Aerospace Power and Propulsion

Level III: UltraSafe Propulsion Project

OBJECTIVE

The objective of the UltraSafe Propulsion project is to reduce engine component failure to an absolute minimum and to contain all possible fragments if an occasional failure does occur. To address this goal, UltraSafe consists of tow technical elements, engine containment and crack resistant materials.

KEY DELIVERABLES

1	Dual microstructure heat treated disk	9/02
2	Prediction accuracy of blade-out events	9/03
3	Corrosion resistant disk material analyzed	9/05
4	Impact resistant material/containment system	9/05

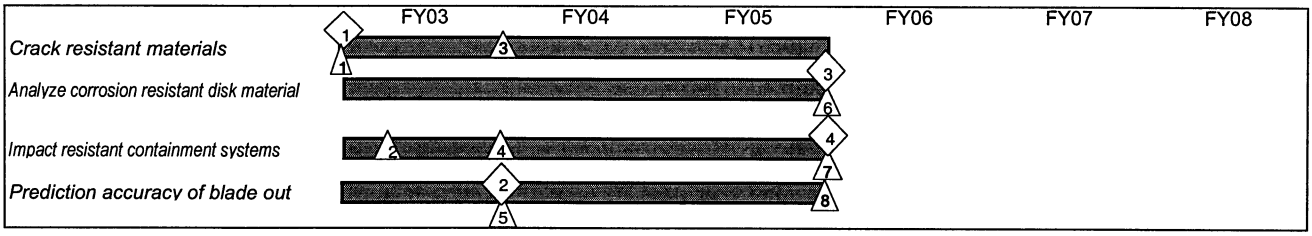
IMPACT

The UltraSafe Propulsion Project is to improve upon the state-of-the-art technology for crack resistant materials, engine containment and blade-out mitigation. This work will encompass research and development of advanced materials, structural concepts and all of the enabling methodologies for modeling, analyzing, designing, and testing at all relevant scales from material coupons through full scale systems. The accomplishment of this project will ultimately contribute to safer, lighter-weight, lower cost and more robust disk materials and containment sytems.

TECHNICAL APPROACH

The approach to address the goals of the project is to develop enhanced, lightweight engine containment materials/systems exploring a variety of "soft" materials, I.e, Kevlar, Zylon, etc., as well as "hard" materials, I.e., metal alloys, lattice block, etc. In collaboration with the ballistic impact tests of these specimens, life prediction models for candidate containment systems will be developed. For the crack resistent materials goal, alloys will be developed, doubling their resistance to failure and life prediction capabilities will be developed for selected materials.

SCHEDULE



MILESTONES

1	**L2 - Spin and burst test dual microstructure heat treat disks (improved creep and fatigue properties)**	**9/02**
2	L3 - Database of metallic and composite materials and structural concepts data established	12/02
3	**L2 - Develop reliable life prediction concepts for advanced Ni-based turbine disk superalloys ('03 GPRA)**	**9/03**
4	L3 - 30% improvement in fan blade containment capacity demonstrated (subscale)	9/03
5	L3 - 50% improvement in blade-out event margins-of-safety prediction accuracy	9/03
6	L3 - Analyze chemical corrosion of superalloy disk materials	9/05
7	**L2 - Develop improved materials and containment systems for engine casings**	**9/05**
8	**L2 - Enhanced analytical modules added to prediction model**	**9/05**

MANAGEMENT

UltraSafe is a Level III project at the Glenn Research Center (GRC). Level I Manager is Rich Wlezien at NASA Headquarters. The Level II Manager is Gary Seng at GRC. The Level III Manager is Susan Johnson at GRC. Level IV Managers are Dale Hopkins and Sai Raj at GRC. This project is in full compliance with NPG7120.5B.

RESOURCES

	FY03	FY04	FY05	FY06	FY07	FY08
Funding (Gross M$)	1.936	2.025	1.000			
Workforce (WY)	14.0	14.0	9.0			

9/20/2002

KEY FACILITIES

	FY03	FY04	FY05	FY06	FY07	FY08
Ballistic Impact Facility						
Propulsion Materials & Struct. Labs						
Analytical Characterization Labs						
Non-Destructive Inspection Labs						

AGREEMENTS

Partner	Agreement Title	Number
GEAE	Evaluation of Advanced Concepts for Fan Case/Containment Systems	SAA3-260
Cleveland Clinic	Advanced Soft Tissue Modeling for Telemedicine and Surgical Simulation	SAA3-445

ACQUISITION STRATEGY

Due to the broad nature of the UltraSafe Propulsion Project, a variety of acquisition instruments will be employed. Free and open competitive procurements will be used to the maximum extent possible. Among the approaches to procurement, the most likely include NASA Research Announcements (NRA), NASA Cooperative Agreement Notices (CAN), and Request for Proposal (RFP). These vehicles will result in grants, cooperative agreements and contracts. For any onsite contractors, performance-based contracts are the preferred instrument.

RISK MANAGEMENT

Risk	Mitigation Strategy
Unexpected developmental difficulties	1. Evaluating raw materials for quality as early as possible 2. Reduce or eliminate that particular material from test matrix
Availability of human resources or facilities	1. Reduce scope of effort and focus on immediate Level 2 milestone 2. Reduce test matrix 3. Seek other facilities that can continue test with limited schedule impact
Insufficient funding to complete milestones or project	1. Develop other sources of funding either from Base Program or from AvSP 2. Complete the immediate Level 2 milestones and delay or eliminate the out-year milestones

TECHNOLOGY TRANSFER

UltraSafe has had a strong effort of working with many tools to promote technology transfer. All of the researchers are dedicated to helping U.S. companies achieve their goals. Collaborations such as SBIRs, Space Act Agreements (Simple, reimbursable and non-reimbursable), several workshops sponsored at GRC and reports have been our major tools. A website has been developed and a display in both the research building and the Visitor Center are in place.

EDUCATION OUTREACH

Optional

SIGNATURES

Gary Seng 9/26/02
Gary Seng
Level II Manager

Susan M. Johnson 9/26/2002
Susan Johnson
Level III Manager